The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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An Industrial Research Policy

THE organisation of research is one of more important problems of post-war planning. There is a manifest difference of opinion, as we have pointed out on other occasions in these columns, as to whether research should be organised or whether the traditional British method of individualism should continue. Certainly, since the D.S.I.R. came into being, research has been organised. It is, moreover, becoming more evident that when research is regarded as an industrial weapon in world competition (whether for fighting a war, or for the arts of peace) the rapidity with which results are secured is a pertinent factor. In any event, research must be organised to the extent of keeping research workers in touch with each other so as to avoid duplication and to "farm out" research where it is most likely to be done successfully. In all this, however, a place must be reserved for the individualistic worker, the brilliant man who would not fit in a team.

The problems of research organisation were discussed by Dr. P. Dunsheath in the recent Atkinson Memorial lecture to the Royal Society of Arts. Dr. Dunsheath regarded research from the industrial angle as being an investment; and as such it is different from other investments in that the return cannot be guaranteed nor even assessed in advance in terms of probability. As research is dependent on adequate financial support, one of the principal considerations in post-war planning is held to be the establishment of public appreciation of the essential difference between this and other forms of investment. The time of fruition is longer and the return to the investor less direct, but the rewards may be stupendous. The investor may be the State or an industrial concern, but the fact that other states or other firms will benefit must not only not be allowed to stand in the way of progress, but should be an additional incentive to expenditure and endeavour, as none can remain prosperous, healthy, or happy in a decaying community. Research alone, in the broadest sense, is the only path to progressive development.

Moreover, as Dr. Dunsheath points out, the problems facing us after the war will be those involving unprecedented reconstruction, during which the problem of diverting war-time activities into peace-time channels with a minimum of social disorganisation will be of paramount importance. The possible social implica-

On Other Pages

tions of a generous extension of industrial research are consequently of great importance.

Before discussing the future organisation of research it is pertinent to determine where we stand in relation to other nations. Dr. Dunsheath estimates that in 1940 in the U.S.A. there were 2200 industrial research corporations maintaining 3500 research laboratories and employing 70,000 workers at a cost of £75,000,000 per annum. Professor Bernal has stated that whereas the U.S.S.R. spends 1 per cent. of the national income in science, the U.S.A. spends 0.3 per cent., and we only 0.1 per cent. Coming to a more detailed analysis, it appears that the difference is largely due to the backward state of research in particular industries. In the chemical, electrical, and metallurgical industries, which are founded essentially on science, great progress has been made, but in others there is much leeway to make up. Dr. Dunsheath maintains that in many industrial concerns what is fashionably called "the research department" is very little more than the testing laboratory for checking the quality of batches of raw material. It appears therefore that one of our essential difficulties in this country is the unevenness in research. Coming close to home, the carbonisation industries are essentially a branch of the chemical industry. In the gas industry there are large sums spent on research and further steps are being taken now through the Gas Research Board to put research on a firm and comprehensive basis. In the other branch of this industry, that of by-product coke ovens, virtually no research is undertaken except a little that is sponsored by the iron and steel industry.

Dr. Dunsheath has described the research organisations and the work of the D.S.I.R. and has discussed the position of patents. All this follows familiar lines and Dr. Dunsheath has no suggestion to make as to what should be the development of patent law in the light of the known difficulties of blocking patents and so forth, beyond a belief that some middle course will have to be taken and that the gap between discovery and inventing a practical application so often requires the expenditure of large sums of money that adequate protection must be given in order to back the invention; otherwise many original ideas will never be brought up to the practical scale. What the future should hold is a problem on which there are many ideas, but beyond stating these ideas Dr. Dunsheath does not take us very much farther towards the solution. He points out that one of the fundamental problems is how to secure the sharing of knowledge between industrial organisations, and he draws attention to the influential committee that has just been appointed by the Federation of British Industries.

One of the greatest services that can be rendered to industrial research to-day is the provision of improved means for the cross-fertilisation of ideas, and this in turn implies that science and industry should be brought into ever closer contact. We suggest that the solution of this problem is to employ scientifically trained men in the higher positions of industry. Rightly or wrongly we are coming to the conclusion that the control of business by commercial men is obsolete and will pass. Most businesses, except those that comprise nothing more than buying and selling, involve technical knowledge as the fundamental of successful operation. The iron and steel industry over the past 20 years has largely replaced the old rule-of-thumb managers by scientifically trained metallurgists, with immense benefit to the industry. This process must be applied throughout British industry and, while financial skill is necessary for the sound operation of business, control should be vested in technically trained men. In our opinion this would be the greatest single step towards making the fullest use of science in industry.

Twenty-five years of trial of the national organisation of research has shown some errors, and in Dr. Dunsheath's view the time has arrived for correcting them "and so raising industrial research to the position which it deserves as an accredited national service." If this country is to maintain a sufficient volume of export trade to secure essential imports of food and raw material, research must become a normal activity of every industry and not simply a service to it. Only by ensuring that the standard of our industrial products is higher than similar products of other countries can we again secure and maintain the position of the premier exporting country in the world.

NOTES AND COMMENTS

First Things First

THE PRIME MINISTER almost always has something new in the bag, and always something stimulating. We doubt whether any section of the British public has more cause to be grateful to him for his stirring speech, broadcast last Sunday night, than the working industrial scientists. It is not that they need an exhortation to stick to their job and get on with it—quite the reverse—but the scientist of all men is best aware of the folly and danger of making promises that it may be impossible to fulfil and of mortgaging an unknown future. It is the misfortune of scientists to-day that they are forced to work for destruction, when their every instinct urges them towards constructional work, and they are fully aware that much of their work in time to come will consist in undoing the very work they are performing to-day. Therefore chemists, physicists, engineers, and all, have a particularly good reason for sticking to their jobs and getting the war over, so that they may then take part in the colossal work of reconstruction which will face them. One special consolation is reserved to them: out of the essentially destructive work they are employed on to-day processes will arise—some have indeed already been recorded—which will be of signal aid in the building up of the future.

Science and the Press

THE newspaper, we are assured by no less an authority than Mr. H. G. Wells, is dead. It is well known, he says, that no news worth reading is to be got from the newspapers, and he suggests, as an alternative, having the news on tap, like the time of day, by way of the telephone dial. This was at the conference on "Science and the Citizen," arranged by the British Association last week-end, to explore post-war possibilities of extending the public understanding of science. Sunday afternoon's session was devoted to "Science and the Press," when Sir Richard Gregory, presiding, declared that the public was ready to take an active interest in the impact of science on social conditions and its relations to life and labour. We agree with him up to a point, but we doubt very much whether the public would thank the editors of newspapers for filling their columns with scientific information, although many reputable journals still (despite the accusation of one speaker) maintain a well-informed scientific column at regular intervals. It seems to us that the whole matter depends on the old dispute as to whether the function of a newspaper is to give the public what it wants or what it ought to have; and that is far too big a question to debate here.

A Scientific News Service

THE technical Press is in a very different position. It will always be difficult to transmit (for example) a complicated chemical formula—say of one of the vitamins or sterols—by telephone; though, of course, one could perhaps have recourse to television for the purpose. But in the meantime quite a fair number of technical journals are being published, containing well-composed articles on various aspects of science and scientific discovery. We do not, somehow, notice a tremendous eagerness on the part of the non-technical public to obtain and peruse such journals! It is easy enough to talk about a "regular, accurate, and up-to-date service of news about scientific developments"; but it is a very different matter to present such news in a way that will be intelligible and attractive to the lay public. The way of the "popular" scientific journal is hard. Before a science news service can be a real value to the public, the public must be educated to use it. Sir Lawrence Bragg seized the point when he said (at another session) that science has not been regarded as an essential part of a balanced education.

Smoke Abatement

IN a general review of its activities for the year, the National Smoke Abatement Society says: "Enough has been published in recent months to indicate the disquiet caused by the suspension of smoke abatement legislation and the direct encouragement, for security purposes, of smoke production from industrial plant. It is as yet impossible to assess the consequences of this regrettable war-time requirement, or to judge its effectiveness for the purposes assigned to it. The position of the

smoke prevention work of the Public Health authorities, in many cases still being developed up to the outbreak of the war, is therefore confused and confusing, but it is apparent that much valuable ground has been lost and that this important aspect of the movement for clean air has been seriously set back." Urgent war problems are obviously of more importance than smoke abatement, even though we may hope to see an ending of the smoke nuisance in large industrial towns and cities; but the question of how to abolish smoke from new buildings, as well as from existing buildings, might well be one of the major considerations of local authorities, in collaboration with the Government, in post-war planning and rebuilding.

Rayon Federation

A FURTHER step in industrial federation, this time with official backing, falls to be recorded. Plans, we hear, are well advanced for the formation of the British Rayon Federation, a centralised authority which will be in a position to speak for all branches of the industry, and which has the blessing of the Rayon Controller, Sir Percy Ashley. Although the Rayon Council, which was set up about a year ago, has fulfilled its functions excellently, it has for some time been felt that a still more forcible co-operative move was required, and the new Federation is the result of this feeling. It is further announced that when the new Federaton is fully embodied, the Rayon and Silk Association will resume its original title and, as the Silk Association, will devote its whole energy to the interests of the silk industry. The council of the new Federation is to consist of 28 representatives, and an executive committee, appointed by the council, will have very full powers, including the regulation of finance, statistical, intelligence, and research duties. The raising of funds will be contrived by means of special levies made on the members with the approval of the council.

Erroneous Impressions

SPEAKING at a luncheon of the Glasgow Branch of the Incorporated Sales Managers' Association, Mr. C. Chapman, Past-President of the London Institute of Plastics, said that there had been far too much talk recently in the Press about what plastics were going to do, and that now we had plastics everything in the garden was lovely. This impression, he added, was quite erroneous, and he wished to de-bunk this business about plastics for houses. There were not enough plastics in the whole world to make 50,000 houses a year. From 100 tons of coal, when used in a gasworks, they got 100 lb. of moulding powder. Plastics, he said, had two distinct outlets—for utility and for decorative uses. We quite firmly agree with Mr. Chapman that glass, steel, wood, and porcelain all have their place in industrial economy, and that there is no likelihood that plastics will interfere with their outlet. As he says "This is a new material of construction, and should be properly used." Full regard should be paid to these remarks, emanating from such a source, and efforts should be made in future to make the utmost use of plastics in the ways mentioned—decorative and utility uses—where the demand must be considerable, especially under normal conditions.

The Industrial Future of Wales

CONTINUATION, in the peaceful years to come, of the war-time development of the industrial resources of Wales was demanded by Dr. Idris Jones, head of the research department of Powell Duffryn, Ltd., in a speech last week at University College, Cardiff. Dr. Jones insisted on the importance of training chemists, engineers, and physicists who could extend existing industries and establish new ones. All will agree with him that Wales is very well blessed by nature to meet the post-war world, having a wealth of coal, sea-water, limestone, dolomite, and agriculture, and the war has proved that Wales possesses plenty of skilled labour. Manufactures in Wales include light alloys, aluminium, calcium carbide, hardened fats and fish oils, refractories, hardware, and fine chemicals, and these would be developed after the war. Synthetic ammonia and methanol production should be continued, and urea and formaldehyde plants erected for plastics manufacture. The fat-hardening industry might be linked with the fishing industry of Milford Haven, while in North Wales light industries such as artificial silk industry and its allied industries should be extended.

Recent Developments in Analytical Chemistry—V

(From Our Analytical Correspondent)

NOW that so much of the scientific literature on organic microchemistry is either only available with difficulty or else is impossible to obtain, a review article of the nature of that published recently by Hallett[1] is doubly valuable to the chemist. In this article the author ranges over the whole field of organic microchemistry, and although no claim is made to exhaustive treatment, the bibliography, containing 378 references, embraces all aspects of the topic. The methods of microchemistry, which at first suffered from over-enthusiasm and misplaced fervour on the part of a number of workers, have now passed into the essential equipment of a fully-trained analyst. Similar surveys in the other branches of microchemistry would be valuable, but it is incontrovertible that in the organic field micro methods are of first importance. The present survey quotes and describes methods designed to enable practically any normal organic operation to be carried out on quantities of material varying from 10 mg. down to a fraction of a milligram. After a section discussing the topic generally and historically, the author first passes under review the operations which have been developed to deal with synthesis and subsequent purification. Micro and semi-micro organic syntheses are referred to, and the subsidiary procedures of recrystallisation, sublimation, the extraction of solids and liquids, fractional distillation, and chromatographic purification on the micro scale are discussed.

Physical Methods

Physical methods play an important part in organic analytical work, and these are given deservedly generous attention. The microchemical balance and weighing operations are considered in a separate section. Melting-point methods and the related topics of molecular weight by depression of the melting point, purity by cooling curves, and mixed melting points are detailed. Boiling point, and purity from boiling-point and from condensation temperature are covered, as well as the various other methods of determining molecular weight—isothermal distillation, vapour density according to Victor Meyer, and osmotic pressure (for substances of high molecular weight). The determination of osmotic pressure by the thermo-electric method is also included in this section.

The section dealing with calorimetry takes account of the determination of heat capacity, heats of adsorption and vaporisation, and heat of combustion both by the oxygen bomb and by the gas calorimeter. Methods for determining the density of solids and liquids are covered, the latter including the "schlieren" method, the use of the pyknometer, the method of balanced columns, and the use of dropping rate. Dielectric constant, and refractive index using the Abbé, the Zeiss, and the Jelley instruments and carrying out the determination either at room temperature or at the melting point of an organic solid next receive attention. These are followed by measurement of specific rotation, and the capillary and "schlieren" methods for determining solubility. The value for surface tension may be determined on small quantities of material by a variety of methods. These detailed here are the du Noüy method, capillary rise, the horizontal capillary method, the double capillary method, and drop weight determination. Viscosity may be measured by using a suitable capillary viscometer; and the value thus obtained may in some cases be applied for the estimation of molecular weight. There is a discussion of the use of the microscope in organic analysis—a field where the applications have not, so far, been as plentiful as in the inorganic field. In this connection, the use of the spectrophotometer and the microspectrograph are also considered.

Qualitative and Quantitative Analysis

Organic qualitative analysis, which is nowadays being systematised on the micro scale, may be carried out on amounts of material varying from a few mg. to 6 mg. Purification, preliminary tests, testing for elements, and the use of classification reactions for compounds

containing carbon, hydrogen, and oxygen only, and for compounds containing nitrogen all find their place at this point.

As is only to be expected, the literature dealing with quantitative organic microanalysis requires a large section, since this field has probably received more attention from chemists than any other branch of the subject, primarily because of the influence of Pregl's work on his contemporaries. Combustion furnaces are described, and oxidation methods for carbon, hydrogen, and nitrogen, as well as Kjeldahl and sub-micro methods for nitrogen, are fully covered. Halogen and sulphur sub-micro methods for nitrogen are fully covered. Halogen and sulphur determinations may be carried out by lime fusion, the Carius method, the Parr bomb, or hydrogenation. Adequate treatment is accorded the less common elements, *i.e.*, arsenic, boron, fluorine, phosphorus, selenium, silica, and metals. The determination of acetyl, carbonyl, carboxyl, methoxyl-ethoxyl, and SH groups, and of unsaturation and active hydrogen, as well as a summary of work on microhydrogenation, complete this section of the review. Constant-pressure and constant-volume methods of gas analysis are next dealt with, and there is a review of special techniques such as the problem of volumetric analysis using very small volumes, micro-diffusion methods and, finally, trace analysis.

Micro Methods in Industry

The article closes with a useful summary of various aspects of the application of these micro methods to industrial analysis. Coal and solid fuels may have extensive analyses carried out on them, either on the micro or the semi-micro scale, methods being available for carbon, hydrogen, nitrogen, sulphur, chlorine, ash, molecular weight, moisture, methoxyl groups, and hydrogenation. It is, of course, obvious that in dealing with explosives the methods are specially advantageous, and carbon, hydrogen, nitrogen, stability, and detonation values are all dealt with. Aniline points, and carbon and hydrogen values for hydrocarbons may be determined. A complete semi-micro analysis of milk may be carried out for total solids, lactose, sucrose, protein, albumin, globulin, fat, chloride, ash, calcium, potassium, iron, and phosphorus. In rubber analysis methods have been evolved, among others, for acetone, chloroform, alkaline alcohol extracts, mineral fillers, total and free sulphur, and accelerators. Micro methods may also play an important part in food, fat, and pulp and textile fibre analysis. The article is lavishly illustrated, and should certainly be available to every analyst for ready reference.

Nitrogen by Kjeldahl

Several recent papers have dealt with the determination of nitrogen in organic compounds by the Kjeldahl method. Bradley[2] recommends that the ammonia produced should be absorbed in water, in a closed system, rather than in mineral acid or in boric acid solution. In this way the necessity for two standard solutions, implicit in the older method, is done away with, and at the same time difficulties that arise in the use of boric acid, such as the slow end-point and the preparation of standard indicator solution, are eliminated. The excess pressure in the closed system is taken up by a rubber balloon attached at the receiving end. It is claimed that the absorption of ammonia is sufficiently complete to ensure that the results are as accurate as those obtained by the classical method.

The boric acid method is varied in another way by Taylor and Smith.[3] The preliminary procedure up to and including the distillation is normal. The boric acid solution containing the adsorbed ammonia is then, however, titrated *potentiometrically* against standard sulphuric acid until its pH is restored to the original value for boric acid. As an alternative to this for very rapid work, a calibration curve of the pH of boric acid solution containing various amounts of added ammonia is prepared. All that is necessary is to make the solution in the receiver after distillation to standard volume, then to measure the pH directly in a pH meter, and read off the ammonia value from the calibration curve. Wicks and Firminger[4] state that if perchloric acid is used as an oxidant in the preliminary oxidation of organic matter, prior to carrying out a Kjeldahl distillation, nitrogen will almost certainly be lost. The use of perchloric acid in this process is therefore to be avoided, particularly in micro work, where the loss can lead to pronounced errors.

Diffusion methods based on the now well-known method of Conway[5] have

been proposed by Prater, Cowles and Straka for ammonia,[6] and by Winnick for alcohol.[7]. In the former paper the authors describe the adaptation of Petri dishes to carry out the analysis, in place of the special diffusion units of the Conway type. Drops of boric acid in glycerol solution are placed on a cover plate, which is inverted over a Petri dish, the evolved gas being absorbed in these drops, which are subsequently titrated against standard acid. The ammonia is liberated from the test solution by a sodium metaborate/potassium chloride solution, and the method has been applied to the estimation of amounts of ammoniacal nitrogen from 0.1 to 9 mg. Winnick's method for alcohol follows the classical procedure. The alcohol is allowed to diffuse from the outer chamber of a diffusion unit into an acid potassium dichromate solution of known strength which is contained in the centre of the unit. The excess dichromate is subsequently determined by addition of potassium iodide, the liberated iodine being titrated against standard thiosulphate.

Technical Analysis

Elving[8] puts forward a plea for the introduction of actual industrial analytical practice into teaching courses after the groundwork of qualitative analysis has been covered. He points out that when students, feeling that they are fully trained, are asked to carry out even the simpler industrial methods according to standard procedure, they are often bewildered by the gap which separates these from the text-book methods which have been taught to them. As a corrective to this, Elving proposes that some of the pamphlets and books which are published at moderate cost by Government departments, associations, and standard-setting societies, should be utilised in the teaching course. He gives a bibliography designed for this purpose which, although specialising in publications of American origin, such as those of the U.S. Bureau of Mines and the American Society for Testing Materials, should nevertheless be of great use, not only to the instructor in analytical chemistry in this country, but also to those actually engaged in this occupation. Each item is accompanied by notes summarising the contents and indicating the applicability of the item. The publisher, or the Government department issuing the publication, is named, and the cost noted. It would be admirable if a similar bibliography applicable to this country's publications could be compiled; the two together would form a very useful basis for an analytical library. Elving's bibliography, while omitting such standard works as Chamot and Mason's *Chemical Microscopy*, Brode's *Chemical Spectroscopy*, and Britton's *Hydrogen Ions*, to name three which come readily to mind, lists a valuable series of American official and trade publications which fall into the following sections: agricultural analysis, coal analysis, gas analysis, metallurgical analysis, microscopy, testing of petroleum products, determination of *p*H, rock and mineral analysis, spectrometric analysis, water analysis, and miscellaneous, the last covering such topics as cement, explosives, textiles, paints, varnishes, and lacquers. Altogether, 10 books, 9 A.S.T.M. collections, 57 specific pamphlets of various sizes (using the term "pamphlet" in a very wide sense), and two general series are listed.

Rubber

The use of the microscope in the rubber industry has been the subject of an article by Allen.[9] The microscope finds its first use in the examination of raw materials for such ends as the measurement of particle size and the control of particle shape. In the region of factory control the microscope affords the best means of ensuring that satisfactory dispersion of pigments has been obtained, while flocculation may also be observed. Certain physical properties may be correlated microscopically with the performance of rubber goods in service. But the most fruitful use of the instrument can be found in the solution of the numerous and widely varying difficulties which turn up, and which are frequently not susceptible of solution by any other means.' The author describes case histories of many typical problems dealing with such topics as impurities, bloom, failure, and deterioration, showing how correlation may be obtained with chemical analyses.

Paints

Stafford[10] has described and discussed an analytical procedure which permits the isolation and identification of the resinous binders used in water emulsion

paints. Three processes are used, either separately or in combination. First, a hot benzene treatment gives three fractions: (*a*) the volatile benzene-immiscible liquids such as water and water-soluble volatile solvents; (*b*) the benzene-soluble material such as resinous binders, and benzene-soluble, water-insoluble solvents; (*c*) the non-volatile benzene-insoluble material, including protective colloids, soaps, driers, benzene-insoluble resins, pigments, etc. The other two processes comprise cold separation with alcohol and benzene, and cold separation with acetone, benzene, and petroleum ether. The resins should be extracted from the solvent on a steam bath in an inert atmosphere. They are examined in the first instance for physical appearance and behaviour, such as smell on burning. Then the physical and chemical constants such as softening range, refractive index, density, and acid and saponification values are determined, after which elementary analysis and solubility tests are carried out. The author gives a series of colour and other classification tests which should be carried out. After preparation of suitable derivatives, other miscellaneous tests may be applied. An instance is the use of the ultra-violet absorption curves to determine the type of conjugated unsaturation in the oils and fatty acids.

In an extended series of articles, Augusti has given systematic methods for the microchemical detection of mineral pigments, particularly those likely to be used in paintings. The earlier papers divided the pigments into white,[11] blue and green,[12] yellow,[13] red, brown, and black.[14] Later papers dealt further with this classification[15] and with the blue and green copper pigments.[16] The most recent paper of this series[17] is concerned with the lead pigments, and enables them to be distinguished by drop reactions or by the methods of chemical microscopy. The pigments dealt with are first divided into four classes, and are then further recognised by microchemical tests.

Spectroscopy

The Ramage method of flame analysis[18] has been coupled by Thruston[19] with classical arc spectrum analysis, so as to provide an easily controlled method of analysis capable of ±5 per cent. accuracy. Paper spills, impregnated with test solution according to the Ramage method, are fed into a horizontally-placed copper or graphite arc carrying a 6 amp. 200 volt direct current. The rate of feeding is so controlled as to produce a total burning time of 40 seconds, and the reproducibility is easier to attain than with an arc which merely has the solution evaporated on the electrodes. Sodium, potassium, calcium, magnesium, manganese, phosphorus, and boron have been estimated in biological materials by this method; but the author points out that it is capable of extension to the determination of other elements. The spectrograph has also been applied to the estimation[20] of arsenic, lead, and copper in foodstuff colours, etc.

Preparing Electrodes

Hodge[21] describes a simple tool for use in preparing graphite electrodes for spectroscopic analysis. It consists of a guider and holder which, when attached to any drill, maintain the electrode in the correct position, and allow it to be bored to the required depth. Following up their work on the theory of quantitative spectrographic analysis,[22] Coates and Armstein show[23] that using Ilford Ordinary plates no correction need be applied to density figures for the distance apart of the lines, if the region 2500 A.U. to 3100 A.U. is employed. The characteristic curve for these plates has a flat portion in this region, so that γ is constant for comparison lines within these limits.

In a recent article Whalley[24] compares the uses, advantages, and disadvantages, as analytical tools, of the spectrograph, the polarograph, and the photoelectric absorptiometers. The three instruments give, in general, results which are comparable in accuracy if the instruments are properly calibrated. The spectrograph, however, is probably to be preferred for the qualitative detection of elements, and the quantitative analysis of solids. Raman spectra have been employed[25] as a means of analysing hydrocarbon mixtures, both qualitatively and quantitatively. Recording of these spectra is simpler experimentally than if the infra-red region is used, and mixtures containing three and four components have been successfully analysed. The quantitative values are calculated from the intensities compared with those given by an internal standard.

(*Continued on page* 345)

British Non-Ferrous Minerals

Improved Technique to meet War-Time Needs

by W. H. REYNOLDS

III.—Fluorspar

THE principal domestic sources of fluorspar are Durham (particularly Weardale and Teesdale) and Derbyshire. It has also been mined in Northumberland, Cumberland, Yorkshire, North Wales and Cornwall, etc. In Durham it is especially abundant in the carboniferous limestones situated in the upper part of Weardale-Stanhope to the source of the River Wear. This is an old lead-mining centre and fluorspar has long been worked there. Some of the known mines are: Stanhope, Seddlings, Stotsfield, Rookhope, Park Burn, and Cambokeils. In the Teesdale area, fluorspar is often associated with galena, as at Coldberry and Pike Law; and in association with barytes as at Grasshill and Langdon Beck. Other sources include: Scordale, Cashwell, and the Westershope Moor. A few miles north of Wearhead, the Allenhead district of Northumberland is another source of fluorspar, but this contains a quantity of zincblende which is absent at Wearhead. In Cumberland, the Rotherhope Fell vein, about 2½ miles south-west of Alston, is from 15 ft. to 30 ft. in width. The fluorspar is of good quality, but closely associated with quartz and calcite, with galena and a little zincblende. Pure lumps are rare.

Derbyshire Spar

In the well-known mines of Derbyshire, fluorspar is found filling the vein fissures in the carboniferous limestones. According to Wedd and Drabble (*Trans. Inst. Min. Eng.*, 1908, *35*, 501-505), the fluorspar deposits are confined to the upper 600 ft. of the limestone, mainly to the uppermost 300 or 400 ft., and do not pass into the overlying grits and shales. The following is a list of mines in Derbyshire: Church Rake and Crich Cliffs, Crich; Star Wood, Ashover, Cupola, Middleton Dale; Eleven Holes, Cromford; King, Matlock; and Wapping, Matlock Bath; in the Eyam vicinity, the Black Hole and Ladywash Mines, etc.; and also at Hassop. The "Blue John" variety, peculiar to Derbyshire, occurs only at the Blue John Mine, Treak Cliff, in the Castleton district. It was sold for ornamental work. It is understood that the original deposit was worked out, but a new vein has since been opened up.

Chief Uses

Fluorspar (CaF_2; sp. gr. 3.18) is usually found in association with other minerals: barytes ($BaSO_4$; sp. gr. 4.5), quartz (SiO_2; sp. gr. 2.65), calcite ($CaCO_3$; sp. gr. 2.8), galena (PbS; sp. gr. 7.6), and sometimes zinc sulphide (ZnS; sp. gr. 4.0). In Weardale one of the chief troubles with fluorspar is the silica content. Mineral impurities are usually found on the walls and embedded in the lump spar, and the spar requires to be broken down to detach the foreign content, which is afterwards removed by mechanical and other means. The crushing, or other methods of reduction, should be effected without the creation of an undue overplus of slimes, thus avoiding the present often serious loss of finished product. The chief uses for fluorspar are: as a flux in electric furnaces for making steel, cast iron, and ferro-alloys; in smelting lead and silver ores and in refining lead and silver; in the manufacture of opal glass; in the preparation of electrolytic refining of antimony and lead; as a flux in the manufacture of alundum and other artificial abrasives and refractories made in electric furnaces; in the manufacture of refrigerants; as an extender in paint; in the iron enamel and ceramic industries; for cementing purposes in the manufacture of emery wheels and carbon electrodes; in the manufacture of artificial cryolite; and in the manufacture of hydrofluoric acid and other fluorine chemicals.

Impurities

Fluorspar for glass manufacture is usually ground so that it will pass a 100-mesh screen, but some is finer and some as coarse as 40-mesh. There are no standard specifications, and widely varying grades are in use for this purpose. The

most objectionable impurity is iron. One large company sets a limit of 0.12 per cent. Fe_2O_3, and states that the average iron oxide content of the fluorspar it uses is about 0.06 per cent. It is stated that silica is not an injurious constituent for glass manufacture, and, being merely a diluent, as much as 10 or 13 per cent. may be acceptable, though resulting in a somewhat lower price. First-grade ground fluorspar for glass manufacture should contain at least 96 per cent. CaF_2 and not more than 2 to 2½ per cent. SiO_2. $CaCO_3$ should not exceed 1 per cent. The sulphides of lead and zinc (galena and zincblende), as well as barium sulphate (barytes) are usually considered to be objectionable, and it is probable that excessive quantities, say over 1 per cent., of any of these materials would cause rejection. In general these remarks apply also to fluorspar intended for enamels and other ceramic purposes. Fluorspar intended for the manufacture of hydrofluoric acid and other fluorine chemicals, is ground either before sale or at the consumer's plant, usually to 80 to 100 mesh. Specifications vary slightly, but usually approximate to the following; CaF_2, not less than 97½ to 98½ per cent.; SiO_2 not over 1 to 1½ per cent.; and $CaCO_3$ not over 1 to 1¼ per cent. Spar particularly low in silica and calcium carbonate is especially valuable for chemical purposes. A rather low-grade acid fluorspar is used in the manufacture of artificial cryolite. High quality acid-grade fluorspar is an important raw material in the manufacture of certain refrigerants and its use for this purpose is growing rapidly.

Pre-War Prices

The pre-war prices of fluorspar in the consuming centres of England, except where otherwise stated, ran somewhat as follows: Low-grade fluorspar 80 per cent. CaF_2, 30s. to 35s. per ton (at mine in U.K.); gravel spar £3 per ton, 85 per cent. CaF_2; lump spar £3 10s. od. per ton, 85 per cent CaF_2; powdered and washed £5 per ton, 85 per cent. CaF_2.—Glass material, SiO_2 not exceeding 5 per cent. £6 10s. od. per ton, 85 per cent. CaF_2; 90 per cent. CaF_2, ground, £8 per ton.—Best glassmaking and acid grade, 98 per cent. CaF_2, SiO_2 less than 2 per cent., £9 per ton.

Permitting the above percentages of impurities to remain indicates an imperfect understanding of the processing technology of fluorspar, and this is especially noticeable in the statement that silica is merely a diluent. In the case of glass alone, uncontrolled percentages of silica in association with fluorspar must cause adverse fluctuations in the percentages of the subsequently prepared "batches" and those fluctuations should be avoided. In the silica glass sand industry, now that the superior foreign imported sand is banned, the practice appears to be the wasteful selection of the best grade white raw sand obtained from any quarry, for the manufacture of glass bottles, whereas the same sand, given suitable treatment, is of special value for crystal and other high quality glassware. In the same manner it seems that those specially favoured with deposits containing a proportion of high quality fluorspar are content to use it wastefully, simply to obtain a questionable cheap advantage over less favoured rivals.

Treatment Misunderstood

In the past plant has been out of date and methods commonly employed have been crude and inefficient. Generally, methods have included hand-sorting, crushing, screening, jigging, and fine grinding; and the mineral is subsequently marketed in three grades—lump, gravel, and ground or sand. By these means the percentage of silica and other impurities has remained unduly high, resulting in a poor-quality product. Where, however, "flotation" has been adopted, some improvement has been achieved, but it still leaves much to be desired. As with barytes and other minerals, the treatment of fluorspar appears to be misunderstood. Present-day results are inferior, chiefly owing to the lack of knowledge, not only as to plant, but also in failure to co-ordinate and bring the operational stages into line with modern processing technique. It has been publicly stated that "although a considerable amount of research has been executed, the separation of the spar and quartz has not been found an economic proposition. Some fluorspar deposits cannot be worked on this account." This statement is quite incorrect because, given improved technique and plant, there can be no excuse for the non-production of a first-class article from approved mines, at a reasonable cost. With

regard to "flotation," the sulphide minerals of most of the base metals can generally be floated without difficulty; therefore "flotation" has special value where the impurities are galena (PbS) and zincblende (ZnS).

Fluorspar deposits are more or less scattered and many are worked as small independent propositions, but despite the war-time labour shortage and machinery difficulties, it would seem that the situation could best be met by the erection of modern well-equipped works: the processing plant, mechanical and chemical, to be automatic and continuous in action. There should be a minimum labour requirement, and the works should be centrally situated for receipt of raw material from selected groups of approved mines. This would enable urgent war requirements to be met, and provide adequate reward for the mine-owners interested. Present-day practices should not be permitted to continue, especially when the raw material and the required technique are readily available. The enhanced value of better-quality product would be noted, as against the present poor-quality grades, the usefulness of which is much reduced. In the case of paint, when "weight" is of primary consideration, barytes (sp. gr. 4.5) is of importance, but when "bulk" and not "weight" is desired, then fluorspar (sp. gr. 3.18) replaces it, provided that both are produced in a pure white state and finely ground. An improved product opens a wide field for profitable export.

As explained in THE CHEMICAL AGE of February 13, the employment of an advanced technique is essential if a high degree of purity is to be attained. Expert examination of the mineral at its source, together with chemical analysis, is imperative before the correct mining instructions can be given and adjustments made in processing technique to suit individual cases.

Recent Developments in Analytical Chemistry

(*Continued from page 342*)

Increasing use of physical methods such as polarography in analytical chemistry gives the analyst a pronounced interest in the subject of the purity of mercury. Wichers, of the National Bureau of Standards, claims[26] that too much time is generally wasted on the purification of mercury which is already sufficiently pure for chemical purposes. According to him, as little as one part per million of any base metal will indicate its presence by the well-known phenomenon of "tailing," while zinc, antimony, and several others of these will cause a surface film if present in only one-tenth of this amount. If the surface is clean, then, and evaporation of a sample at 200° C. shows no noble metals to be present, further attempts at determining the purity of mercury are a waste of time, since the only more sensitive test is by electromotive force measurements (which will disclose the presence of as little as one part of zinc in 10^{10} of mercury).

Probably the most satisfactory method for the purification of mercury is by agitation, using a stream of air, in contact with a solution of nitric acid/mercurous nitrate. Addition of a little hydrogen peroxide to the wash may aid purification, especially if sulphide is present. The air stream alone, without an acid wash, may prove quite effective by direct oxidation. The mercury may then be filtered through a pinhole aperture to remove scum, washed with water, and dried by heating in a well ventilated fume cupboard at 150° C., when it is ready for use. But it is stressed that before purification it is as well to make sure that the operation is really necessary!

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LETTER TO THE EDITOR

"Waste" Products of Oil Refining

SIR,—You are undoubtedly rendering a great service to the development of the oil industry in this country by repeatedly pointing out its importance for the development of a modern chemical industry, as you have done in your leading article of February 20, and as Mr. J. E. Walker does in his article appearing in your March issues.

It is very unfortunate, indeed, that during the past twenty years which saw these major developments, oil has been considered in this country more from the importers' and distributors' than from the industrial angle. I am glad that Dr. ter Meulen's most instructive statement on solvent extraction has aroused the interest it merited, and, having been closely connected with the development of solvent extraction and dewaxing with SO_2 and benzol, in which my company was one of the pioneers, perhaps I may be permitted to add just one more aspect which, in my opinion, is important as an example for the whole question of petroleum refining in this country.

Originally, the aromatic extracts of the solvent refining of lubricating oil were considered as a low-grade fuel oil and almost as waste. Further concentrated research has shown that they are valuable raw materials for the production at moderate cost of large quantities of rubber and plastic extenders, plasticisers, and for the manufacture of paints. In the not too distant future their value may be higher than that of the lubricating oil for which the plant was originally built.

In oil refining perhaps quicker than in any other industry the waste product of to-day becomes the main product of to-morrow. Oil refining on a large scale in Great Britain was discouraged in the Falmouth Report, published in 1938, because of its wastefulness in producing considerable quantities of cracking gases. These cracking gases have in the meantime become the main source of supply of 100-octane aviation fuel and more recently one of the main sources for the production of synthetic rubber and many other important chemicals and solvents.

In many circles there is a dangerous attitude that we should let other countries develop processes and then acquire their experience by way of licence. Unfortunately, past experience has shown that when a certain industry was developed in a country that country was unlikely to lose its leading position, as the licensor is always one leap ahead of the licensee—experience with dyestuffs, pharmaceutical products and artificial fibres should have taught us that lesson.

The new development of the chemical industry is inaccurately described as "based on oil." It is really "based on oil refining," for only the treatment of crude oil yields, as by-products in large quantities at low cost, those hydrocarbons the importance of which for the whole development of the chemical industry of the future cannot be over-rated. Nothing can frustrate the development of a new industry more decisively than the complete lack of raw material.—Yours faithfully,

F. KIND, Ph.D.,
Managing Director,
Manchester Oil Refinery, Ltd.

London, E.C.4.
March 22, 1943.

Parliamentary Topics

Silicosis

IN the House of Commons last week Sir J. Wardlaw-Milne asked the Home Secretary whether any investigation had yet been made as to the extent to which silicosis had been contracted by workers in the foundry trade, and with what result. Mr. Morrison replied that certain processes in steel foundries were known to give rise to silicosis, and workers employed in these processes were covered by the compensation scheme for this disease. He had recently received representations that the scheme should be extended to cover other processes, *e.g.*, work done on the foundry floor, which had not hitherto been thought to expose the workers to risk of the disease. Further inquiries were being made, but the results were not yet available.

Coal Research

Mr. James Griffiths asked the Minister of Fuel and Power whether he could make a statement indicating what steps were being taken to develop methods and processes of utilising coal, particularly of derivatives from coal; and what his Department was doing in this matter. In reply, Major Lloyd George said that while his Ministry was not directly responsible for the conduct of research work, it was in close touch with the Fuel Research Station of the D.S.I.R., which was carrying out an extensive programme of research into the properties of coal, its utilisation, and the utilisation of its by-products. His Ministry was also in touch with the B.C.U.R.A., the Coal Research Board, and other industrial research bodies engaged on important work in this field. Moreover, the Ministry was in control of the coal-tar industry and of the production of benzol. Considerable progress had been made in substituting the liquid products of coal for imported petroleum products and the Ministry had acquired much valuable information bearing on the production and utilisation of coal by-products.

Developments of the Patent Situation

War-Time Difficulties

by S. T. MADELEY

THE year we have but recently left behind has seen some very important developments affecting inventors and patentees. None more so than in the field of chemistry, on which we are yearly becoming more dependent for our existence. Let us examine what has happened against a background of vitamins and hormones, for example, the importance of which we are seeing ever more clearly.

Vitamins and Hormones

In 1933 hormones were isolated from animal tissues and liquids. Their structure was investigated, and pure crystalline hormones were prepared from them. This research was continued in 1934, when an approach was made to their synthesis. Advance was made towards the manufacture of compounds or derivatives partaking of their physiological propertes, and in 1935 sex hormones and some vitamins and enzymes were synthetically prepared. The next year saw the isolation of oestrone, and many of their stereo-isomers were characterised. It was noticed that stereo-chemical structure greatly affected otherwise identical compounds in their physiological activity. Methods of increasing the potency of the hormones were developed in 1937. Vitamins were concentrated in 1938 by short path high-vacuum distillation, and in 1939 considerable advance was made in the synthesis of important vitamins, following on the discovery of their chemical structure. Consequent on the identification of the structure of the hormone of the adrenal cortex, its synthesis was dealt with. As was to be expected, there was a further increase in invention relating to vitamins in 1941 and 1942. Below is a table of approximate numbers of British patents relating to vitamins as accessory food factors, granted over the period 1930-42.

Year.	Patents.	Year.	Patents.	Year.	Patents.
1931	8	1935	11	1939	18
1932	12	1936	11	1940	22
1933	5	1937	19	1941	19
1934	5	1938	31	1942	16

Owing to lack of space a single fairly recent example of a British patent must suffice us: *549,351* (Standard Brands, Inc.). Solution of vitamin B1 for addition to milk, etc. To an aqueous solution of gelatine, in which there are about 10 mγ of gelatine per ml., up to one gramme of thiamin (vitamin B) per ml. is added (γ = 0.0001 mg.). There must be a considerable number of patentees who have patents issued or pending similar in nature to the above in this country and in the United States. They will naturally be anxious to know how matters now stand with them in this direction.

Recent Judgments

This will be more particularly the case owing to the important judgment delivered by Mr. Justice Simonds in the course of last year. Actually, the judgment was delivered in a petition for extension of term of Patent No. 260,906, relating to paving blocks. But that does not matter, as the application is much wider. In the course of his judgment the following principle was laid down: It is incumbent, in the case where the patentee relies upon section 18(6), to give as much information as he can to the Court in regard to any profits which have been made in respect of foreign letters patent, because it might be that what he has lost by reason of the war in respect of trade in this country, he has gained by trade in a foreign country where he is covered by his foreign patent. This prolongation was made without prejudice to future further application under the 1942 Act. In another Court the extension granted was, on grounds of this nature, shorter than it might otherwise have been.

In a later case, extension was made for the full war period without prejudice to further application. In a further case where there had been extensive use during the war, a short extension was granted and only loss to date was taken into account. This was the established practice under the 1942 Act.

Agreements with the Crown

In the case of the Meredith & Cooke gyroscope patents, merit also came into consideration besides section 18(6). Great merit was admitted, and actually in each case eight years' prolongation was granted. The patents were "secret" and were assigned to the Crown under Section 30 of the Acts. They were reassigned to the inventors after six years' Crown "user." There was an agreement between the patentees and the Crown that they should give to the Crown 45 per cent. of their profits arising out of commercial exploitation of the patents. An exclusive licence was given to S. Smith & Sons (Motor Accessories), Ltd., who were also the assignees of the corresponding foreign patents. Although Smith & Sons did their utmost to exploit the patents, they came out about even, neither making nor losing on the

deal. Meredith & Cooke made about £5000 out of their British, and a similar sum out of their foreign patents. They handed over some £4500 to the President of the Air Council according to agreement.

Through the Comptroller, the Crown opposed the petitioners' prolongation. In the final event, extensions of eight years each were allowed. The Judge's rulings are of particular interest, as they have wide appliion. They were to the following effect. The Crown need not attempt to assess the value to itself of inventions during the period in which they are vested absolutely in it, and insufficiency of payment offered or made to a service inventor respecting his inventions will not be considered by the Court, where Treasury regulations cover the reward payable. In Section 30 cases, a petitioner cannot rely on assignment to the Crown by a Service inventor as having deprived the petitioner during the assignment period of the chance of exploiting the invention. In cases involving an agreement between the Crown and the inventor as to division of the proceeds of exploitation of the invention, the terms of the agreement being alterable by a specified Secretary of State, the Court will not review such terms. Regarding inventions made by a Service inventor in the course of his employment, he should not be in a worse position than an ordinary employee under contract concerning inventions he has made during his employment.

Sections 29 and 30

The magnitude of the difficulties surrounding inventors and patentees will be realised when the various Acts and Statutory Rules and Orders affecting them are reviewed. This we will now endeavour to do. Section 30 of the Patent Acts, we may remember, covers not only applications which are made "secret" in the interest of the public service, but all cases where the inventor of an improvement in instruments or inventions of war assigns his invention to the Secretaries of State for War or Air, or to the Admiralty. Section 29 of the Acts relates to the right of the Crown to use patentees' inventions, through its agents if necessary, and the conditions of remuneration for such use. The Amending Act of 1942 limits to ten years extensions of term of patents where the prolongation is granted under section 18(6) of the principal Act. This sub-section entitles a patentee to apply for an extension of term of his patent on the sole ground of loss or damage due to hostilities. The Amending Act also strengthens the Government's hand in respect of Section 29 by including unpatented inventions, and protects purchasers of surplus Government stock made under Section 29.

The 1942 Act also contains provisions extending the scope of Section 91 of the principal Act, which section, it will be recollected, is the Conventon section; it regulates the priority rights, as to date and so on, of patent applications emanating from abroad. Sub-section 91(a) of the new provisions empowers the Comptroller to extend the time for filing documents, paying fees, etc., in Convention cases, where delay has been caused by the law or action of the Convention country concerned, under certain conditions. Sub-section 91(b) protects subsequent applicants for patents, etc., where the supply or mutual exchange of articles or information relating to an invention has taken place between this country and another which grants similar privileges. To some extent the new Act merely clarifies and extends the Comptroller's powers under Section 6 of the Patents, Designs, Copyright and Trade Marks (Emergency) Act, 1939.

Comptroller's Powers Extended

Under this Emergency Act, Sections 1 and 2, the Comptroller has already very wide powers to revoke or vary existing licences, or to grant emergency licences under patents, etc., owned by enemies or enemy subjects. Under Section 4 he may refuse to take part in proceedings or suspend the taking of proceedings in relation to enemy patent applications, although the Act does not forbid such applications. Section 6 gives him power to grant extension of term relating to patents, etc., or procedure, when delay has arisen owing to the war. This Act followed closely upon the Defence Regulations, 1939, in so far as they applied to patents. They gave the Government wide powers in a general way over patentees.

The Government's and the Comptroller's powers were more clearly defined by S. R. & O. 1941, No. 1780. According to these regulations the Comptroller may, on the advice of the Government, prohibit or restrict the publication or communication of information relating to a patent application. No one may apply in a foreign country for a patent without his permission. "Foreign," incidentally, includes mandated countries but not British Dominions, etc. The Government may direct any person in possession of information relating to any invention, design, or process, to furnish such information to the Government or its agent, and the Government or agent is protected in the use thereof. But this disclosure alone will not invalidate a subsequent application for a patent. As regards emergency licences, any licence granted subsequent thereto under a patent, without the Comptroller's certificate of approval, is void, except under certain conditions.

A patentee is not sure of getting a contract under his own patent. But disagree-

ment as to royalty, etc., will not debar him from so doing, as he may in case of dispute get one "ex-royalty." Government contractors are expected to incorporate Government conditions in their sub-contracts, and to inform the Government of any patents, etc., they need to work under. They must pass on to the Government for settlement any claims for royalty, etc., under such patents. Government requirements over-ride any existing licences.

Agreement with the U.S.A.

S. R. & O., 1942, No. 1882, gives effect to the agreement with the U.S.A. (Trade Series, No. 8) relating to inventions. The Lord President of the Council, the Admiralty, the Minister of Supply, or the Minister of Aircraft Production, may for war purposes direct certain people to grant licences authorising the use in the U.S.A. by the said authority or its agent, of an invention, discovery, or design. The persons concerned are those who are now resident in the United Kingdom or have so been since the war began and are in possession of any right respecting the said use in the U.S.A. Remuneration will be settled by the Treasury or a tribunal specified by it. Subject to certain exceptions, no one may, without written permission of the said authority, agree to give information facilitating the manufacture of any articles in the U.S.A. or grant for any right or grant any licence or other interest, present or future, respecting the use in the U.S.A. of any invention, discovery or design. The British Government may give information concerning an invention to any Department of the U.S. Government.

Finally, it may be noted that the new Board of Trade licence restricts to payment of renewal fees Patent Office procedure relating to patents, etc., owned by enemies or enemy subjects, and that only provided there are funds in this country which the Custodian of Enemy Property considers may be properly applied to such purposes. Allied States such as Belgium, Czechoslovakia, Greece, Holland, Norway, Poland, Yugoslavia, etc., have certain exceptional rights in this connection. Inventors and patentees will require very generous treatment after the war to make up for their present disabilities, or our patent system and all its great and valuable advantages will hardly survive.

Swiss Chemical Prospects

Domestic Resources Examined

SWITZERLAND'S chemical industry has suffered greatly as a result of the war which has made its traditional export trade almost impossible. Not only do Swiss chemical factories suffer from the interruption of normal trade with many overseas countries, but difficulties of transport and raw material supply are equally severe, and there is also a serious fuel problem. The leading export firms doubt whether they will be able to resume their export connections after the war, and such an expert as Dr. M. A. Konz, the head of the section for chemistry in the Swiss Ministry for War Industry and Labour, is of the opinion that considerable adjustments will be necessary. There are, however, opportunities for the development of certain local raw material sources. Gypsum has been investigated as a source of sulphuric acid for fertiliser manufacture, and there are hopes for the expansion of special glass manufacture, for the exploitation of bitumen and oil-shale deposits, and for the production of artificial cryolite needed for the Swiss aluminium industry. Synthetic rubber, however, could not, it is thought, be economically manufactured, but there are undoubted possibilities in the field of synthetic resins and lacquers. Hopes are also being entertained with regard to fermentation processes and the production of films, and vitamin research has already yielded results.

Raw Materials Guide

Useful Government Publication

OWING to supply difficulties many raw materials are subject to Government Control and licences to purchase and acquire as well as to import or export are required. The Ministry of Supply has now compiled *The Raw Materials Guide* in response to urgent requests, and this guide should be of special interest to those concerned with the various commodities. An index gives the list of commodities outlined in the guide and includes among others, abrasives, arsenic, asbestos, bromine, camphor, chrome ore, magnesite, wolfram, dolomite, felspar, fertilisers, fluorspar, graphite, gums, industrial ammonia, industrial gases, iodine, iron and steel, jute, kapok, liquid resin, mica, miscellaneous chemicals, molasses and industrial alcohol, natural asphalt, non-ferrous metals, shellac, sillimanite, sulphite lye, and sulphuric acid.

The Guide gives an idea of the nature and land of origin of the commodities, outlines the procedure for obtaining supplies, the measure of control exercised over dealings, and, by giving a summary of the Statutory Rules and Orders restricting the movements of the materials, provides a survey of the commodity from the start of the Control. The Raw Materials Branch concerned with each commodity is indicated, and the address of the Control. Monthly addenda are to be published to notify changes in Control and procedure. The price is 1s.

Science and the Citizen

British Association Conference

A CONFERENCE organised by the British Association, through its division for the social and international relations of science, was held at the Royal Institution during the week-end to discuss "Science and the Citizen: the Public Understanding of Science." Sir Henry Dale, Pres.R.S., Director of the Royal Institution, presided at the opening session, the subject of which was: "The Exposition of Science," and he said we had moved, though without any general awareness, far into an era in which the discoveries of science had become an essential constituent of the common fabric of our every-day life; an era in which some knowledge of science had become a necessity of any reasonably civilised life. Nothing would suffice short of such a recasting of our schemes of education as would give to science its proper and central place at every stage, in elementary, secondary, university and adult education.

Sir John Anderson, Lord President of the Council, P.C., M.P., in a message wrote: that the group of research organisations over which he presided, together with the research organisations of industry and the laboratories of universities and private investigators, would have a vital contribution to make to the solution of post-war problems. That contribution could only become really effective if the general public appreciated not only the powers but the limitations of scientific research. Much harm might be done if those without scientific training were encouraged, by well intentioned but extravagant advocacy of the marvels of science, to expect from science alone remedies for all the social problems with which we shall be faced. Indeed, the full harvest of the national scientific effort would not be reaped unless the same intensive and penetrating consideration was given to the application of scientific results as was called for in their original accumulation.

Education to Blame

Sir Lawrence Bragg, F.R.S., speaking on the exposition of science, said scientists were often accused of being too technical in their presentation of their subject. The main trouble was that science had not been regarded as an essential part of a balanced education. However, a knowledge of science was rapidly becoming more widespread. It was much easier to give a popular scientific lecture to young people than to their parents; they had a background and both understood the points and appreciated the interest. He added that: "a very important relation between the scientist and non-scientist is that between the scientific expert and industrial leaders. We have a number of fine industrial laboratories in this country, but we cannot consider we are making full use of our scientific assets when we compare ourselves with Germany and America. The leaders of industry often owe their positions to their commercial and financial ability rather than to their technical ability. Scientists are too often regarded as experts to call in when there are troubles, not as colleagues to call in when making plans. They are allowed to give tactical help, but not to take part in strategy. Again, education has been to blame and should provide the cure."

Professor J. A. Lauwerys said that in education the museum had been neglected. Our great national museums were second to none in the world, and 200 were good, but the remaining 600 were junk shops. He suggested that as part of the post-war rebuilding there should be put up in each city a civic centre in which one of the most important buildings would be the museum of science, illustrating, too, the relationship between industry and society. It also ought to be a museum of Social Sciences, such as Dr. Neurath established and ran with success in Vienna.

"Radio and Cinema," "Science as a Humanity," and "Science and the Press" were other subjects discussed during the conference. Sir Richard Gregory presided at the session when "Science and the Press" was debated, and claimed the public was ready to take active interest in the impact of science upon social conditions and its relations to life and labour.

New Control Orders

China Clay

In accordance with the China Clay (Charges) Order, 1943 (S. R. & O. 1943, No. 413), which came into force on March 17, the Treasury has enacted that a charge of 3s. 6d. per ton of china clay sold or disposed of in the period of three months beginning March 17, or any subsequent three-months period shall be paid by the seller to the Board of Trade within 14 days of the end of the specified period. The money so paid shall, after defraying expenses, be applied to the care and maintenance of china-clay works which by reason of the Production of China Clay (Restriction) Order, 1942, have ceased production or may cease production in the future.

Processed Aggregates*

Expanded Shales for Light-Weight Concretes

PROCESSED or manufactured light-weight aggregates are those obtained by treating raw materials so as to attain certain properties in products designed primarily for use as concrete aggregate. There are two main classes: expanded shales or clays, and expanded slags. All expanded shale or clay aggregates are made by the same basic process, which is essentially the rapid elevation of the temperature of a prepared raw material to a point between its incipient and complete vitrification temperatures. In this temperature range, which is reached just before discharge from the kiln, the shale or clay softens, becomes sticky, and tends to trap evolved gases. The material is discharged in this condition and cooled rapidly to retain the cellular structure. Since raw shale or clay particles ranging in size from 48 mesh to 1¼ in. are fired together and all show the same degree of expansion, it is evident that the bloating occurs only after the material passes its temperature of incipient vitrification.

Also, at this temperature the evolved gases are given off more rapidly than just before incipient vitrification, thereby indicating new source compounds from which the gases are derived. In the burning of bricks and formed clay products, it has been shown that black-coring and bloating, or expansion, are due to the carbon, iron, and sulphur contents of the raw materials. Sulphur is claimed to be the final or actual cause of the swelling, chiefly by the reactions of sulphides, sulphates, and silicates, to release sulphurous gases. Carbon and iron maintain a reducing atmosphere that conserves sulphur by preventing its early oxidation. In addition, carbon may provide some gases for expansion, and iron aids by forming low-melting-point silicates. The sulphur content provides gases for expansion at an increased rate when temperatures of 1100° to 1200°C. are reached.

The Effect of Carbonates

A carbonate content probably is an additional source of gases at the vitrification range, because dissociation or calcination of these compounds under the rapid-firing schedule still would be in progress when the material softens. Presence of free lime in some expanded-shale aggregates indicates the rapid dissociation of carbonates after softening and before solidification of the discharge. In the patent literature a commonly suggested practice is to add small quantities of one or more of the foregoing substances to facilitate expansion of a clay or shale. Clays and shales with short ranges of vitrification are claimed to be better adapted to the manufacture of expanded aggregates than are those with long ranges. The latter soften gradually and thus permit escape of the evolved gases.

Patent Aggregates Described

Cel-Seal, a pelletised, expanded-clay aggregate (U.S.P. 2,015,381), was formerly known under the trade names Globulite and Vesiculite, both of which have been abandoned. In the manufacturing process low-fusion-point clay is mixed with small percentages of iron oxides and carbonaceous material and made plastic with water. It is then extruded through a multiple die as round pugs, which are cut into small billets by a rapidly-rotating wire as they leave the die. Size of the finished aggregate is controlled by diameters of the die-openings and speed of the cutting wire. The billets pass through a revolving cylinder, in which they are rounded and coated with powdered refractory clay that has a higher fusion temperature than the main body of the pellet. The pellets are expanded in a rotary kiln operated at a temperature above the fusion point of the centre clay and below that of the coating. Although the centres expand to a cellular mass four to seven times the original volume, the coating remains fairly intact, is more dense than the centre, and is partly vitrified but not fused. About 20 min. are required for the burning operation. An alternative process (U.S.P. 2,199,046) is to coat the pellets with oil or tar and to expand them by burning to a finished aggregate of individual pieces that have substantially uniform characteristics throughout. Recent experimental work has developed an insulating-weight Cel-Seal aggregate that weighs as little as 6¾ lb. per cu. ft., and has been used with other binders, such as gypsum and asphalt.

The aggregate "Gravelite" is made commercially under U.S.P. 2,035,845 in a rotary-kiln plant. It is comprised of expanded-clay pellets, of which the coarse sizes weigh 40 to 45 lb., and the sand size about 55 lb. per cu. ft. in a saturated, surface-dry, loose condition. In the process, clay or shale is ground, pugged, and forced through a multiple die, from which the extruded cylinders of clay are cut into pellets of the desired length. Only pellets of substantially uniform size are made at one time. The pellets of a relatively narrow range in size are coated or sprayed with fuel oil and expanded by firing counter-flow in a rotary kiln. Discharge from the kiln is cooled and screened into three standard size

* Abridged from an article in the *Ceramic Age*, November, 1942, p.152.

ranges. Concrete containing "Gravelite" as both fine and coarse aggregate weighs 75 to 85 lb. per cu. ft. when dry. "Gravelite" concrete is an effective thermal insulator for service temperatures up to about 875°C.

"Haydite," an expanded-shale aggregate, is made under U.S.P. 1,255,878 and 1,707,395, assigned to the American Aggregates Co., Kansas City. Under the present method of manufacture, "Haydite" can be made from a great variety of shales and clays. The raw shale or clay is crushed to pass a 1½ in. screen and then fed directly to a rotary kiln. The rotary kilns are commonly 50 ft. in length and 6 ft. in diameter and are pitched either 1 or ¾ in. per ft. They are fired counterflow, usually by pulverised coal. Oil and natural gas also are satisfactory fuels. Kiln temperatures which are determined by the vitrification range of the raw material, are generally about 1100°C. at the discharge end and 300°C. at the feed end. The shale or clay remains in the kiln 30 to 40 min. while it is being heated at a rate fast enough to reach incipient fusion just before discharge. At this point the material softens, coalesces, and appears to have a consistency of chewing gum. Escaping gases are trapped and form a vesicular structure with an increase in volume of about 50 per cent. The sticky mass is discharged and cooled and thereafter is crushed and screened to the various aggregate sizes. Insufficient heating and fusion lower the crushing strength of the aggregate, and overburning causes more complete fusion and loss of part of the cellular structure. In properly burned "Haydite," particles as fine as 48-mesh exhibit the same typical vesicular structure as shown by the large sizes. At plants using raw material containing excess calcium, water is added to the kiln discharge to hydrate any quicklime that may have formed.

"Haydite" concrete has been developed as an insulating material suitable for temperatures up to 1100°C. Although the "Haydite" aggregate generally fuses between 1200° and 1250°C., the concrete does not fail completely until about 1300°C.

Diatomaceous Shale

Low-grade diatomite and diatomaceous shale has been processed for use as lightweight aggregate in ordinary concrete by crushing to minus 1 in. size, screening to remove fines, spraying with oil, and burning in a rotary kiln at a maximum temperature of about 1100°C. At this temperature organic impurities are burned out, and the clay present in the raw material is expanded so that the product weighs 40 to 50 lb. per cu. ft. This type of diatomite aggregate is manufactured in California, where it is available under the trade names "Diacrete" and "Raylite." An oil-impregnated diatomaceous shale has been made in California by a patented process (U.S.P. 2,112,380) into a light-weight aggregate called "Airrox." Raw shale, crushed and screened into sizes up to 1 in., is mixed with ground limestone, and the mixture (95 per cent. shale and 5 per cent. $CaCO_3$) is fed to a rotary kiln 125 ft. in length and 7 ft. in diameter. On entering the high-temperature zone the shale fragments fuse on the surface and pick up a coating of lime, which prevents the pieces from agglomerating and also combines with the silica of the shale to form a thin shell of calcium silicate. The fragments become soft throughout, and evolved gases expand the interiors to produce a vesicular structure. The tumbling action of the kiln rounds the fragments so that the discharge has a smooth appearance, with a dense, impervious shell. The aggregate weighs 35 to 40 lb. per cu. ft. in a saturated, surface-dry, loose condition.

In the Scandinavian countries scarcity of natural light-weight substances such as pumice has caused light-weight aggregates to be processed from loams. In the process plastic loams are pugged and fed directly to coal-fired rotary kilns, in which the material is vesiculated or expanded at 1200° to 1400°C. Two plants in Sweden and one in Denmark are reported to be making this type of aggregate.

TESTS FOR AGGREGATES

The new B.S. 812 for the sampling and testing of mineral aggregates, sands and fillers, has just been issued by the British Standards Institution. The foreword explains that opportunity has been taken to make some necessary corrections in earlier tests and to include some additional tests and modifications that have subsequently been adopted by various committees of the B.S.I. For example: (a) Method for the determination of the specific gravity of aggregate; (b) aggregate crushing tests; (c) approximate test for voids; (d) suitability of aggregates for concrete; (e) description of physical characteristics of aggregates; and (f) chemical analysis of blast-furnace slag aggregate. Copies may be obtained from the B.S.I., price 3s. 6d. post free.

A new State enterprise for the production of salt has been formed in Bulgaria. "Solopodem" is to exploit rock salt deposits at Provadia, near Varna, where the present yearly production of 15,000 tons is to be doubled. The Bulgarian Ministry of Agriculture is interested in the production of salt at Porto Lagos, on the coast of Aegean Sea, and salt is also obtained by evaporation at Burgas, on the Black Sea, where 36,000 tons are produced annually.

Fuel-Economy Campaign

Plastics Federation's Work : New Official Guidance

WITH the object of assisting its members in approaching the problem of fuel economy in the industry, the Council of the British Plastics Federation has issued a memorandum to act as a guide. In July last year the Federation was asked to consider the formation of a Fuel Efficiency Committee, and it was decided to appoint a committee of eight members, drawn from the following sections: Plastics Material Manufacturers, Moulding Powder Manufacturers, Moulders, Synthetic Resin Manufacturers, and Laminated Material Manufacturers; and Dr. A. C. Dunningham, I.C.I. (Plastics), Ltd., was elected chairman. A circular was issued to the 200 member-firms in the Federation, followed by questionnaires asking for statistics covering average annual consumption of gas, electricity, and coal and coke for heating and process work, and also with the object of arriving at figures showing the amount of fuel consumed per unit product in the industry. An analysis of the replies received to one of the questionnaires was divided into returns for London and the Home Counties, S.E. England, N.E. England, N.W. England, S.W. England and Wales, the Midlands, and Scotland.

Main Problems

The memorandum says that problems of fuel economy in industry may be divided broadly into two groups: (a) the generation, and (b) the utilisation of heat, steam, and power. The problems of the efficient operation of boiler plant are common to all industries. They necessitate the measurement of the fuel used and the steam produced, together with the heat losses in flue gases and ashes. For the control of these losses to be effective, instruments for the measurement of the CO_2 content and temperature of the flue gases are a necessity. Efficient operation of boiler plant is the first essential for fuel economy and should be the care of a competent engineer. As to the utilisation of heat, steam, and power, in certain sections of the plastics industry, especially moulding, a large number of relatively small units have to be heated separately, and the problem of efficient usage of heat is not an easy one, and should be given careful consideration. Characteristic processes of the plastics industry involving the use of heat and power are also mentioned.

Points Mentioned

In a section dealing with process utilisation of heat, it is pointed out that steam heating is probably the most general method adopted, and, without proper insulation of mains, considerable losses may occur in conveying the steam from the boiler to the various points of application. This is also true of H.P. hot water. Points to remember are: (1) moisture in steam can reduce the efficiency of steam-heated equipment, and one of the first problems is to reduce moisture losses as far as possible by efficient covering on all piping and steam flanges; (2) steam separators should be installed at suitable points, provided with strainers, check valves, and traps; (3) leaking joints, valves and traps may be responsible for serious losses. At a pressure of 100 lb./sq. in., a leakage area equivalent to a 1/32 in. hole will cause a loss equivalent to 2½ tons of coal per annum; (4) a 6-in. flange on a main, at 100 lb./sq. in., will waste 1 ton of coal per annum, if not lagged: (5) steam traps should be chosen correctly for the conditions under which they have to work, and should be maintained in an efficient condition to prevent leakage of steam. As to steam heating, the importance of maintaining steam traps in an efficient condition cannot be over-emphasised. Presses used in the plastics industry require a controlled temperature of from 130° to 180°C. according to the process, so that the sensible heat in the condensate cannot be recovered in the press. This makes it very necessary for all condensate to be recovered and returned to the boiler feed water or to some other point where its sensible heat can be utilised. When heating by H.P. hot water, both outward and return mains require insulating, and for efficiency of utilisation with gas and electric heating, precautions with regard to insulation and avoidance of idle spells must be observed. Hot water or steam used for heating buildings may be very wasteful if not properly controlled, and a thermostatic control system is the best remedy for this as temperature can then be maintained at any desired level.

New Bulletins

The Ministry of Fuel and Power has recently issued for the Fuel Efficiency Committee new bulletins: "Thermostatic Control," "Fuel Economy by Saving Electricity," and "Operation and Maintenance of Gas Burners," and copies have been sent to all large industrial fuel consumers. Thermostatic control, the first bulletin states, is a satisfactory means of preventing fuel loss through overheating by allowing the right amount of heat to be released at the right place, and details are given of some of the applications of thermostatic control. Interesting suggestions

for saving electricity in factories are given in that dealing with electricity, while that on gas, compiled in collaboration with the Gas Industry, gives a series of hints on the best means not only of saving gas but also of saving trouble to the operative. The Ministry has also issued a broadsheet, "Fuel Efficiency News" which is to be published monthly and sent to firms in the hope that it will stimulate the application of the technical information disseminated by the Ministry and encourage them to co-operate in the economy campaign.

Pyrethrum in India

A New Crop

PYRETHRUM cultivation is still in its infancy in India, although efforts have been made to introduce the crop there during the last few years. In 1937 the Imperial Council of Agricultural Research seriously considered the matter of introducing pyrethrum into India, and observed that there were possibilities of growing it profitably and that the matter should be further examined by experiments in suitable places. With that end in view the Council obtained seeds through the India Office and distributed them to different provinces and States. Again, at the beginning of 1940 some seeds were obtained from Dalmatia. For a number of years, experiments were carried out in different agricultural departments. In some places its cultivation was a failure and in others it was hopeful and promising. This crop fared well and proved successful in the Punjab, in Assam, and in Kashmir. Promising results were also obtained from certain parts of Nilgiris and N.W. Frontier Province. Bombay, United Provinces, Sind and Mysore were declared unsuitable.

Analyses for the pyrethrum content of the flower samples obtained from different places show the following results: samples from Kashmir and the Punjab possess a pyrethrum content of .95 per cent. and .96 per cent. respectively. The pyrethrum concent. of N.W. Frontier Province samples ranges from .61 to 1.11 per cent., whereas the Assam samples contain 1.13 per cent. Indian samples are, however, still below the level of those from Kenya. Assam, as the product of her soil is found to contain a higher percentage of pyrethrum, seems to be eminently suitable for its cultivation, and may even be able to compete with Japan and Kenya.

Experiments have shown that pyrethrum in India thrives well at an altitude of approximately 4000 feet and above, and it has been observed with certainty that it will grow best in a comparatively dry climate with well-drained light soil. Yields of about 400 lb. of dried flowers may be obtained per acre in some parts, but not everywhere.

Rayon Developments

Wide Scope of New Association

THE new British Rayon Federation, mention of which is made in our editorial pages, will comprise, when its formation is complete, all the existing organised branches of the industry, including the Rayon Producers Committee, Rayon Weaving Association, Rayon Warp Knitters, Rayon Staple Spinners' Association, National Federation of Hosiery Manufacturers' Associations, Flat Dyed Rayon Group, Rayon Crêpe Dyers Group, Spun Rayon Fabrics Dyers' Group, Federation of Calico Printers, British Rayon Crêpeists' Association, Processers' Association, Rayon Section of the Cotton and Rayon Merchants' Association, and London Rayon Merchant Converters.

The council of the new federation is to consist of 28 representatives, and the executive committee, which will be appointed by the council, will consist of the chairman and vice-chairman and the following representatives: three rayon producers and one representative each for weavers, knitters, staple spinners, hosiery manufacturers, dyers and merchants.

ALUMINIUM CO-ORDINATION

A Combined Aluminium Committee, representing the United Kingdom, the United States, and Canada, has been established to co-ordinate the activities of the three countries. Mr. Charles E. Wilson, executive vice-president of the War Production Board in Washington, will serve as chairman of the committee. The other members are Sir Richard Fairey, director-general of the British Aircraft Commission in Washington, and Mr. George C. Bateman, metals controller of Canada. The committee will report its findings to the Combined Production and Resources Board and the Combined Raw Materials Board.

CRYOLITE AS INSECTICIDE

The use of cryolite for the control of insects infesting crops of various kinds has passed the tests of controlled experimentation and practical application. Fluorine compounds were used as insecticides as early as 1896, but no serious experimental work was undertaken until about 1924. After about five years of investigation, cryolite and barium fluosilicate emerged as the most promising of the fluorine-containing insecticides. The Aluminium Ore Company, Pittsburgh, Pa., recently produced a synthetic cryolite (sodium aluminium fluoride) under the trademark "Alorco," containing 46 per cent. fluorine, which is equivalent to 85 per cent. cryolite. It is processed by a special precipitation system to produce extremely fine particles.

Personal Notes

MR. R. L. PRAIN has been appointed Controller of Quartz Crystals by the Minister of Supply. All communications relating to the supply of these should be addressed to the Controller at Portland House, Tothill Street, London, S.W.1 (Tel. ABBey 7788).

Among the newly-elected Fellows of the Royal Society, the following are specially distinguished in the fields of chemistry or metallurgy: SIR S. S. BHATNAGAR, Director of Scientific and Industrial Research, India; A. J. EWINS, director of research, May & Baker, Ltd.; J. J. FOX, Government Chemist and Past President of the Institute of Chemistry; G. A. R. KON, Research Professor of Chemistry at the Royal Cancer Hospital; ANDREW MCCANCE, director and general manager, Colville's, Ltd.; and CHARLES SYKES, Superintendent of the Metallurgy Department, National Physical Laboratory.

Obituary

MR. JAMES W. BROADFOOT, of Colvilles, Ltd., Glasgow, steel and pig iron manufacturers, died at Toronto on March 14.

MR. ALEXANDER CHRISTIAN, for many years a chemist with Rankin and Borland, Ltd., died at Kilmarnock on March 12.

MR. HENRY WILLIAM CHRISTIE, who died at Alexandria, Dumbartonshire, on March 17, aged 69, was chairman of the United Turkey Red Co., Ltd.

MR. ROBERT ARMSTRONG BELL, one of Huddersfield's oldest manufacturing chemists, and managing director of R. A. Bell and Co., Ltd., died on March 15, aged 73.

MR. ALFRED ELDERS, chairman of the Newcastle Zinc Oxide Company, Ltd., and founder of Messrs. Elders, Walker and Co., Ltd., paint manufacturers, has died at South Shields, aged 84.

DR. HAROLD GORDON RULE, lecturer in chemistry at Edinburgh University, has died in Edinburgh. Dr. Rule was in charge of the organic chemistry department and did much useful research work, but was, perhaps, best known to chemists for his translation of Julius Schmidt's "Organic Chemistry."

MR. J. C. HARRINGTON, Editor since 1916 of the *Leather Trades Review*, one of the publications of Benn Brothers, Ltd., died at Wimbledon on March 20, aged 73. For over fifty years he gave all he had to the leather industry. While with the tanning firm of John H. Fleming & Sons, of Warrington, he became a frequent contributor to trade journals, and in 1918 he became secretary of the Fellmongers' Association of Great Britain and Ireland.

Society of Chemical Industry

Council Retirements

THE Council of the Society of Chemical Industry announces the following forthcoming retirements; *Vice-Presidents*: E. B. Anderson, *W. P. Cohoe, *R. T. Colgate, H. E. Cox, F. P. Dunn, T. H. Durrans, F. A. Greene, *B. G. McLellan, F. M. Potter, E. K. Rideal, *H. L. Riley, Sir Robert Robinson. *Ordinary Members of Council*: A. L. Bacharach, J. H. Bushill, *G. Dring, G. M. Dyson, J. B. Firth, *C. S. Garland, H. McCombie, H. W. Rowell, F. S. Sinnatt, Foster Sproxton, *A. J. V. Underwood, *H. V. Potter.

Those marked with an asterisk are due to retire, having completed their term of office. Mr. H. V. Potter, however, is eligible for re-election as his was an interim appointment to take the place of G. Stafford Whitby who resigned. There is a fifth Council vacancy caused by the death of Dr. Sinnatt. Nominations to fill these five vacancies must be made on form B, which can be had on application to the General Secretary. Retiring members of Council can be nominated to fill vacancies in the list of vice-presidents. Nominations, which should be received at the office, 56 Victoria Street, S.W.1, not later than the morning of April 6.

Leverhulme Lecture

Dr. William Cullen, president of the Society of Chemical Industry, announced at a joint meeting of the Liverpool Section and the Food Group, attended also by members of the British Association of Chemists, the Institute of Chemistry, and the Chemical Society, on March 19, the foundation of a Leverhulme Memorial Lecture to be given annually before the Liverpool Section of the S.C.I. The inaugural lecture will be given on June 29 by Mr. H. Ballantyne, a colleague of the present Lord Leverhulme and of his late father on the board of the company.

Dr. Cullen said that when he was preparing his presidential address he came to the conclusion that very little had been done to commemorate the work of the great pioneers of the chemical industry, who had made it what it was to-day. He thought the most appropriate way this could be done was to approach those most intimately interested. In this connection, no name was more appropriate than that of Lord Leverhulme. An immediate and generous response was made by Lord Leverhulme through the Leverhulme Trustees, with the result that the memorial lecture was established. Dr. Cullen thanked Lord Leverhulme and the Leverhulme Trustees for their fine gift. Lord Leverhulme had been a catalyst on this occasion and the virus had affected the whole of the chemical industry.

General News——From Week to Week

The Society of Chemical Industry has announced that the telephone number of its new offices is VICtoria 5215. The actual move (reported in our last issue) takes place on March 29.

Major Lloyd George has stated that the Ministry of Fuel and Power now has 25 coal-briquetting machines in action. He hopes that by next autumn they will be producing hundreds of thousands of tons of this fuel.

Female labour now represents about 30 per cent. of the total strength of the British Aluminium Co., Ltd., according to the annual report just issued. They are stated to be carrying out their work with great zeal and efficiency.

A useful reference book on Government publications affecting home trade, entitled "Croner's Reference Book on Home Trade Regulations," has just been published by U. H. E. Croner, of 48 Cambridge Road, Teddington, Middlesex, at a price of one guinea.

The Industrial Alcohol Committee, which is reviewing the question of the grant of an allowance from the Exchequer in respect of industrial alcohol, is now prepared to receive statements which individual concerns and associations interested as producers or users of industrial alcohol may desire to submit.

New treatment of the heating of steel cores, used for munitions work in a Midlands factory, has resulted in a 22 per cent. cut in gas consumption. The cores were formerly heated to 400° C. by allowing an open gas flame to play on them, until a representative of the local gas department suggested that they should be heated in an oven with thermostatic control.

The Southern section of the Institute of the Plastics Industry was inaugurated at Southampton on March 13, when the possibility of establishing a centre of the plastics industry there was envisaged in a speech by the chairman of the section, Dr. Harry Barron. Members of the sectional committee are Messrs. C. B. H. Clark, T. Gilbertson, H. P. Grinyer, and A. Macauley, and Mr. G. L. Barron is hon. secretary.

A second edition of "War-time Information for Pharmacists" has been compiled by *The Pharmaceutical Journal*, the official organ of the Pharmaceutical Society of Great Britain. At the low price of 1s., pharmacists can study a summary of Acts of Parliament, Defence Regulations, and Statutory Rules and Orders issued up to the end of February, which have a bearing on their practice of pharmacy. A comprehensive list of addresses is also included.

Sir John Duncanson, Controller of Iron and Steel Supplies in the United Kingdom, has arrived in the United States. He is to accompany Mr. E. A. Emerson, president of the Armco International Corporation of Youngstown, Ohio, on a joint Anglo-American survey of the steel situation in Australia, New Zealand, India and South Africa.

Foreign News

The Reynolds Metals Co., Louisville, Kentucky, U.S.A., will erect a further plant to fabricate aluminium at Louisville, at a cost of over $1,500,000.

The Belgian iron and steel industry is being concentrated by the Germans to facilitate the deportation of workers from heavy industries to Germany, according to the Belgian News Agency.

About 10,000 women have been admitted into the engineering industry in the Union of South Africa (up to the beginning of 1943), and are reported to have proved most valuable.

The Mexican Government Oil Company proposes to spend a sum of 50 million pesos to develop the pipeline from Poza Rica to Mexico City and to increase the output of oil.

The Chemical Factory, Ltd., a subsidiary of Prager Chemische Verein, plans the manufacture of sulphuric acid, copper sulphate, and superphosphate and other fertilisers in Yugoslavia.

Among the projects of I.G. Farben, according to the American Press, is the transfer of 7000 skilled French workmen from closed-down chemical plants to its own works in Germany. It is not recorded how many of these have been "induced" to transfer.

Important new plant for the lamination of copper and tin has been erected by the Laminadora Nacional de Metais at S. Caetano, a suburb of S. Paulo, Brazil. Metals mined in the neighbourhood will be treated in the new plant.

Kenya has begun to produce a new kind of buoyancy filling—named Flotite—for life belts. Flotite, which resembles the kapok obtained formerly from the Dutch East Indies, is a floss found on certain trees. A pilot plant has been started and samples are being examined.

A chemical holding company, with a capital of RM. 500,000, has been registered in Berlin. Its name is "Dom" Finanz-G.m.b.H. für chemische Unternehmungen. The new company is interested in the pharmaceutical manufacturing firm of Gödecke and Co. and other chemical enterprises.

Precious metals may be obtained in Germany only on presentation of approved certificates, and applications must show the net weight of metal requested, including calculations for alloys, and, in the case of platinum, must be accompanied by a technical statement of purpose.

The attempts of the U.S. steel industry to ease the shortage of electric furnace alloy steel are gaining headway. After a month of experimenting, bullet core wire is now being made from cold-drawn open-hearth steel, thereby releasing some of the electric furnace capacity for other purposes.

A report issued by the Argentine Industrial Union shows that in 1942 Argentina produced 200,000 tons of edible oil and that imports have ceased. The growth of the Argentine oil industry is attributed chiefly to the disappearance of Italy and Greece as world suppliers, and to shipping difficulties encountered by Spanish exporters.

Among problems discussed recently by the Inorganic Acids Industry Advisory Committee in Washington has been the supply of an adequate quantity of sulphuric acid for aviation fuel manufacture on the West Coast, the recovery of alkylation sludge acid, the possibility of extending the use of hydrofluoric acid in aviation fuel production, and procedure for the disposal of spent acid.

The mining industry in Peru has been operating at record levels, but some mines may soon have to limit their operations for lack of urgently needed supplies. Another obstacle is the scarcity of ships for carrying the raw materials to the United States for the manufacture of mining equipment. Mines yield copper, tungsten, molybdenum, vanadium, antimony, lead, and zinc, most of which are exported to the U.S.

Efforts are being made to remedy the shortage of fluorspar in America. A 30,000 ton flotation mill is being erected with Government funds, five new producers of metallurgical fluorspar are expected to come into production this year, and expansion of production is being sought in the minefields of Colorado, New Mexico, and Newfoundland. A restricted list of users to whom fluorspar of metallurgical and ceramic grades may be supplied has also been published.

News of developments in the lead industry has been coming from the research and testing laboratories, New York, where every effort is being made now to increase the services of lead in the war effort. Hardly a day passes but some practical new use of this plentiful metal is recommended for serious trial, the latest being a hard lead caulking ferrule which is said to have withstood severe tests and is adaptable to welded or wiped solder joints. This will, it is claimed, conserve the more costly brass at no sacrifice of durability or safety.

A representative of the United States Board of Economic Warfare is being sent to India to co-operate with the representative of the Ministry of Supply in the operation of the Indian Shellac Procurement Programme. The present system of public purchase of all shellac for importation into the United States and the United Kingdom will be continued, and no change in the prices paid for shellac is contemplated.

According to a review recently published by the Aluminum Company of America, United States production of aluminium in 1942 amounted to over a billion pounds. When the 1943 peak is reached, the producing capacity of the U.S. will be more than two billion pounds annually, exceeding by 63 per cent. the entire world output in 1938. Expansion of fabricating facilities is keeping pace with that of the metal itself. It should be remembered that the American billion equals a thousand million.

Forthcoming Events

At a meeting of the **Mineralogical Society**, at 4.45 p.m., on **March 28**, in the Geological Society's rooms, Burlington House, Professor W. T. Gordon will give a lecture entitled " Industrial Diamond."

On **March 31**, at 1.45 p.m., a lecture on " The Chemical Attack upon Pests " will be delivered to the **Royal Society of Arts** by Dr. R. E. Slade.

The Midland section of the **Institute of Fuel** will hold an informal meeting at the James Watt Memorial Institute, Birmingham, at 2.30 p.m., on **March 31.** A discussion on " The Burning of Pitch Creosote Mixtures " will be opened by Mr. H. M. Brack.

A meeting of the Agricultural Group of the **Society of Chemical Industry** will be held at 2.30 p.m., on **March 31**, in the London School of Hygiene, Keppel Street, W.C.1, when a paper of " Design of Drying Machines for Agricultural Products " will be presented by Mr. W. H. Cashmore.

The 21st annual corporate meeting of the **Institution of Chemical Engineers** will be held in the Connaught Rooms, Great Queen Street, W.C.2, on **April 2.** The business session, at 11 a.m., will be followed, at 12 noon, by the president's address on " The Chemical Engineer in Reconstruction."

The fourth and last in the series of lectures on the Modern Power Station will be given before the **Royal Society of Arts**, at 1.45 p.m., on **April 5.** The speaker, Mr. C. W. Marshall, will take as his subject "High Voltage Power Circuit Control."

Mr. A. H. Bennett will give an address on "The Sicilian Chemical Industry" before the London section of the **Society of Chemical Industry** at 2.30 p.m., on **April 5.** The meeting will be held in the Chemical Society's rooms, Burlington House.

A meeting of the **Electrodepositors' Technical Society** will be held at the Northampton Polytechnic, St. John Street, E.C.1, at 5.30 p.m., on **April 5,** when a discussion will take place on "Devices for Controlling the Distribution of Electro-Deposits," opened by Mr. C. J. Leadbeater.

The last of Sir Lawrence Bragg's four lectures to the **Royal Institution** on the Solid State will take place at 3 p.m., on **April 6.** The title will be "Present Day Developments."

The Birmingham section of the **Electrodepositors' Technical Society** will meet at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 6 p.m., on **April 6,** when a paper on "Applications of Heavy Nickel Deposition" will be presented by Mr. L. Wright.

The **Institute of Fuel** will meet in the Geological Society's rooms, Burlington House, at 5.30 p.m., on **April 8,** when Mr. F. McNeill will present a paper on "The Purchase of Coal by Industrial Users," to be followed by a discussion.

Readers are reminded that the second conference on X-Ray Analysis in Industry, organised by the **Institute of Physics,** as announced in our columns on February 20, will take place in Cambridge on **April 9** and **10,** opening at 2.15 p.m. on the first day, and ending at 4.30 on the second.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

COPPER AND ALLOYS, LTD., West Bromwich. (M., 27/3/43.) March 8, charge (supplemental to charges dated July 19, 1940, and March 26, 1942), to Anthony Gustav de Rothschild and Rothschilds Continuation, Ltd., securing £60,000 (not ex.) (inclusive of amount secured by said charges); general charge. *£20,000. December 31, 1941.

County Court Judgments

IODRESS, LTD., 134 Gladstone Road, Wimbledon, manufacturing chemists. (C.C.J., 27/3/43.) £13 3s. 2d., February 12.

Satisfaction

E. AND F. RICHARDSON, LTD., Buckingham, varnish and paint manufacturers. (M.S., 27/3/43.) Satisfaction, March 9, of mortgage registered June 20, 1939.

Receivership

GREENWOOD AND CHESTERS, LTD. (R., 27/3/43.) C. Haywood, C.A., 25 Acresfield, Bolton, appointed receiver and manager on March 3, 1943, under powers contained in instrument dated June 10, 1942.

Company News

Thompson Brothers (Bilston), Ltd., announce an interim dividend of 7½ per cent. (same).

The British Aluminium Co., Ltd., announces a final ordinary dividend for 1942 of 7 per cent., making 10 per cent. (same), and a profit of £569,869 (£517,332).

Rex Campbell and Co., Ltd., 7 Idol Lane, E.C.3, have increased their nominal capital by the addition of £1000 beyond the registered capital of £1100.

Thomas Firth and John Brown, Ltd., announce a final ordinary dividend of 5½ per cent., making 10 per cent. (same), and a net profit, for 1942, of £311,357 (£307,236).

The Ruberoid Co., Ltd., announce a final dividend of 6 per cent., making 8 per cent. for 1942 (same), and a net profit of £54,094 (£56,303).

Fison's, Ltd., announce a net profit for the year ended September 30 last, of £83,034 (£64,689). The dividend of 10 per cent. has already been announced.

Yorkshire Indigo, Scarlet and Colour Dyers, Ltd., announce a dividend on the preference shares of 10 per cent. for two years to December 31, 1939, and a profit of £7867 (£7199).

The Viscose Development Co., Ltd., announce a final ordinary dividend of 5 per cent., making 8 per cent. (7 per cent.) for 1942, and a trading profit of £86,630 (£55,767).

New Companies Registered

Doncaster Coke and By-Products Company, Ltd. (379,250).—Private company. Capital: £25,000 in 25,000 shares of £1 each. Colliery, coke-oven and by-product works proprietors, dealers in coal, gas, coke and all derivatives and by-products of the distillation of coal, etc. Subscribers: C. D. Wright, 34 Ellers Avenue, Doncaster; C. Jacques. Solicitor: C. M. H. Glover, Doncaster.

Balla Products Company, Ltd. (379,166).—Private company. Capital: £1000 in 1000 shares of £1 each. Manufacturers of and dealers in chemicals, fertilisers, oil, grease, colours, etc. Subscribers: P. van Meus, D. N. Giannacopulo. Registered office: Room 63, Broad Street Avenue, E.C.2.

Extinguere Company, Ltd. (379,217).—Private company. Capital: £200 in 200 shares of £1 each. Manufacturers and assemblers of and dealers in fire extinguishing and prevention appliances, etc. First directors: O. W. Jones, A. Baker. Registered office: Extinguere Works, Stephenson Street, Canning Town, E.

Chemical and Allied Stocks and Shares

ALTHOUGH sentiment in the stock and share markets was assisted by the confident nature of the Prime Minister's speech, the volume of Stock Exchange business was again small. It is recognised that yields on most classes of securities are very moderate, and that, owing to the weight of taxation, there is little scope for early recovery in dividend payments. Nevertheless, industrial shares are firmly held in many instances because of hopes that after the war a gradual return to dividends approaching the rates ruling before 1940 may be possible. It is recognised, however, that it is difficult to form definite views as to the future, because much may depend on Government policy. Nevertheless, the invariable tendency in the stock and share markets is to attempt to discount the future a long way ahead.

Imperial Chemical remained steady, awaiting the dividend announcement, and at 39s. 1½d. were slightly better on balance, while the 7 per cent. preference units at 35s. 7½d. were the same as a week ago. Borax Consolidated deferred, which remained under the influence of the results, were well maintained at 34s. 4½d. General Refractories 10s. shares had a firm appearance at 15s. 10½d., the market having remained hopeful that the forthcoming results may show further recovery in earnings. B. Laporte were again held firmly and quoted at 78s. "middle." Similar remarks apply to W. J. Bush at 50s.; the interim dividend of the last-named company falls to be announced next month. International Paint were 111s. 3d., and various other shares of paint manufacturers were higher under the influence of recent dividend announcements. Resumption of dividends by Paripan has been followed by a sharp advance in this company's 5s. shares to 18s. 6d., Cellon 5s. ordinary were 17s. 6d., and Goodlass Wall 10s. ordinary remained around 13s. In respect of 1941 the latter company was able to record an excellent rise in trading profits, but the weight of taxation was such that net profits were slightly lower, although it was possible to keep the dividend at 6 per cent. Maintenance of the dividend at this rate is generally expected for 1942. The yield is not large at the current price of the shares, but this is an instance where the price reflects hopeful market views as to the scope for expansion in profits after the war. Shares of concerns interested in plastics were active, but there were few changes on balance. British Industrial Plastics 2s. ordinary were around 5s. 10½d., Erinoid 11s. 6d., and Lacrinoid Products around 4s. 7½d.

Lever & Unilever were in better request and improved further from 35s. 3d. to 35s. 9d., while Lever, N.V., held their recent improvement to 30s. British Aluminium at 49s. 1½d. were slightly lower, but are now "ex" the dividend; while awaiting the results, British Oxygen held their improvement to 77s. 3d. Murex gained 1s. 3d. to 105s., the prevailing view being that maintenance of the forthcoming interim dividend is a reasonable expectation. Elsewhere, Birmid Industries ordinary improved from 84s. to 84s. 6d. Turner & Newall were slightly better at 75s. 3d. and, at the time of writing, Dunlop Rubber have remained at 34s. 9d. British Match were higher at 38s. 3d. the market being hopeful that the results, due in May, may show the maintenance of the dividend. Awaiting the financial results, Associated Cement were better at 59s. 9d., compared with 58s. 9d. a week ago, and elsewhere, British Plaster Board gained 6d. at 28s. Boots Drug were 3d. up at 40s. 9d., but at 14s. 1½d. Beechams deferred lost part of their recent improvement. Timothy Whites were 27s. 9d., and Sangers 22s. A better tendency developed in Anglo-Iranian and other leading oil shares.

British Chemical Prices

Market Reports

ACTIVITY appears to be sustained in most sections of the chemical market and delivery specifications during the past week have covered good volumes. The demand for the soda products continues on a good scale with items such as sodium chlorate, sodium nitrate and sodium hyposulphite in good demand at firm rates while steady sales are reported for bicarbonate of soda, Glauber salt and salt cake. The potash chemicals generally are being promptly absorbed, in most cases by priority users. Yellow prussiate of potash continues in very short supply, and is largely nominal so far as values are concerned. Acid phosphate of potash is very firm and a steady demand has been reported. In other directions formaldehyde is the subject of a steady inquiry and producers are well sold while a

strong market is again reported for arsenic, supplies being readily taken up. Glycerine is maintained at the controlled levels and finds a ready outlet for all the available supplies. Makers of the red and white leads have indicated no change in the price situation and a steady business in most descriptions is being put through. Firm price conditions are reported from the coal-tar products market with a moderate buying interest from home users of pitch. Creosote oil is in good demand and an active inquiry continues for the toluols and benzols.

MANCHESTER.—The Lancashire and Yorkshire textile and allied trades are taking fair quantities of chemical products against contracts, and traders on the Manchester market during the past week have reported a moderate inquiry both from these and other outlets for industrial chemicals, with the price position firm in all sections. Most of the soda products are fairly active, and there is a steady absorption of offers of potash compounds, while in the magnesia and ammonia sections business has been on quietly steady lines. The tar products, especially the light classes, are being taken up satisfactorily against contracts.

GLASGOW.—In the Scottish heavy chemical trade there is no change in the position for home business which maintains its steady day-to-day transactions. Export trade is rather restricted. Prices remain very firm.

100 REBUILT Hydro Extractors by all leading makers from 18 in. upwards with countershafts attached and safety covers. Jacketed Steam Pans, various sizes. List on request. Seen at Randalls, Arundel Terrace, Barnes. Telephone: Riverside 2436.

1000 STRONG NEW WATERPROOF APRONS. To-day's value 5s. each. Clearing at 30s. dozen. Also large quantity Filter Cloths, cheap. Wilsons, Springfield Mills, Preston, Lancs. Phone 2198.

TWELVE 400-ton Cake Presses, W.P. 2 tons, Tables 36 in. by 18 in., suitable for conversion for moulding. THOMPSON & SON (MILLWALL), LTD., Cuba Street, Millwall, London, E.14. East 1844.

SERVICING

GRINDING of every description of chemical and other materials for the trade with improved mills.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams: "Hill-Jones, Bochurch, London." Telephone: 3285 East.

AUCTIONEERS, VALUERS, Etc.

EDWARD RUSHTON, SON AND KENYON (Established 1855).

Auctioneers' Valuers and Fire Loss Assessors of
CHEMICAL WORKS, PLANT AND MACHINERY,
York House, 12 York Street, Manchester.

Telephone: 1937 (2 lines) Central, Manchester.
Telegrams: "Russoken," Manchester.

WORKING NOTICES

THE Proprietors of British Patent No. 477,743 for "IMPROVEMENTS IN HYDRAULIC GYPSUM CEMENT MATERIAL AND PROCESS OF MANUFACTURING THE SAME" desire to enter into negotiations with a Firm or Firms for the sale of the Patent, or for the grant of licences thereunder. Further particulars may be obtained from MARKS & CLERK, 57 and 58 Lincoln's Inn Fields, London, W.C.2.

WANTED, back numbers of THE CHEMICAL AGE as follows:—
1941, March 15th.
1941, October 4th and 25th.
1941, November 1st, 8th, 15th, 22nd and 29th.
1942, February 7th and 21st.
Please reply to THE CHEMICAL AGE, 154 Fleet Street, London, E.C.4.

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